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SMALL-SCALE BUILDING MATERIALS PRODUCTION IN THE CONTEXT OF THE INFORMAL ECONOMY *

prepared by the

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(Habitat)

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PREFACE

There is little doubt that significant achievementsare being made in various industrial sectors of the economies of developing countries. The leading role of the construction sector, if effectively incorporated in that process, can contribute substantially to attaining the 25 per cent target of industrial growth set by the Lima Declaration in 1976 within a reasonable time-period. Perhaps the most important contribution that the construction sector can make to industrial growth is through its consumption of intermediate inputs, notably, building materials. In some developing countries, the cement, steel and wood industries, for instance, have already made an impact on industrial growth. Therefore, the building materials sector should be accorded a high priority in national industrial development.

In spite of some encouraging trends, the building materials industry is still unable to meet the demands made on it, and it is yet to maximize its contributions to development. This is due to the fact that indigenous building materials, which can lead to self-sufficiency and import substitution, have not been adopted on a wide scale.

UNCHS (Habitat) recognizes the importance of the building materials industry, especially because of its linkages with other sectors of the economy, its ability to stimulate industrial growth, its potential to generate income-earning opportunities and its technological flexibility in terms of sensitivity to labour-capital substitution. In particular, within its field of competence and as the focal agency for the International Year of Shelter for the Homeless, UNCHS (Habitat) is concerned with measures which will not only increase the industrial output of the building materials sector, but, in addition, lead to a significant improvement in shelter and related facilities for the least advantaged in society.

It is against such a background that this report has been prepared as the UNCHS (Habitat) contribution to the First UNIDO Consultation on the Building Materials Industry, in its capacity as a co-sponsoring agency of the Consultation. The report concerns the small-scale production of building materials in the context of the informal economy with the underlying purpose of examining ways to increase contributions to the indigenous building materials industry. UNCHS (Habitat) wishes to acknowledge the valuable support rendered by Mrs. E.J. Wells and Mr. D. Miles in the preparation of this report.

SUMMARY

Building materials, as the single largest input in construction activities, represent at the same time the main bottleneck in the construction industry in many developing countries. The latter issue is due to the fact that the availability of basic building materials has often been dependent on imports, using up foreign exchange, while there is a vast yet undeveloped potential to produce adequate supplies of building materials from abundant indigenous resources. In terms of shelter and basic infrastructure for the rural and urban poor, building materials, at times, are thus both the only input and drawback to self-help and community participation approaches in construction.

So far, a large proportion of building materials used for the construction of shelter by thelower-income groups, which constitute approximately 70 per cent of the total population in developing countries, have been produced in small-scale units, both in the rural and urban settlements, often using indigenous resources. In character, building materials produced in this manner, are largely informal when related to conventional processes. However, in spite of the informality, they have made a meaningful contribution to national economic development in several ways. Apart from the fact that a bulk of housing for the low-income population will remain dependent solely on this system of building materials output, there is evidence of high employment and skill generation, as well as useful economic multiplier effects through backward and forward linkages to other sectors of economy. Above all, there is a potential for further strengthening these contributions. First of all, there is the large unfulfilled demand for shelter by the low-income population which is now reaching an alarming stage and secondly, future contributions can be measured, for instance, through the possible substitution of the informal sector products with the demands of certain other categories of construction output, especially in view of the wide range of production scales within the informal sector and the frequent interactions with the formal sector.

The benefits notwithstanding, several factors have made it impossible to achieve adequate supply of building materials from the sector at reasonable costs and at acceptable quality, thereby limiting the wide-scale adoption of such materials even by the low-income population. These factors of constraint, especially those which are inherent to the informal sector, such as lack of basic inputs for production, low quality of products, and unfavourable factors of demand in terms of markets for the products, can be reduced if certain measures are implemented.

Much as the concept of informal sector building materials production may seem undefined to some extent, mainly because of variations in definition and importance from one country to the other (thereby making a standard set of measures inappropriate) the reality of the situation in several countries makes it necessary to attempt certain developmental measures. These are related to the availability of basic inputs, provision of regulatory procedures in the quality of products, application of research results and innovations in technology and the promotion of shelter construction programmes based on available local resources for the low-income population.

INTRODUCTION

Building materials are the main input to the construction industry which in turn is an important contributor to capital formation As economic growth is directly related to the level and efficiency of capital formation, it is therefore also linked directly to the capacity and productivity of the construction and building materials sectors, and the importance of promoting indigenous materials industries in the developing countries cannot be overemphasized. In recognition of this fact, the achievement by developing countries of self-sufficiency in building materials production has been adopted by UNIDO as part of the goal of generating 25 per cent of world manufacturing output from these countries by 2000 - the target set in the Lima Declaration and Plan of Action in 1975.

Progress towards this target since 1975 has, however, not been satisfactory. Although there have been some important gains in the production of building materials in developing countries, improvements have been concentrated in the prosperous countries of the group. Thus, while developing countries have improved their percentage of global production of building materials by substantial margins during the 1970s, imports of building materials are still predominant, with many African countries importing as much as 60 per cent of their requirements. 1/

The majority of developing countries have followed a policy of import substitution by way of industrial development strategy. Such a policy has also been applied in the building materials industries. This frequently means the establishment of local industries to produce materials identical to those previously imported - a process known as import reproduction. The local reproduction of previously imported building materials and components generally means that raw materials inputs used in the production process must continue to be imported (except where there are suitable local resources, although even when these exist, they are not always developed). This process usually also involves the importation of machinery and equipment which characteristically are capital intensive and require large quantities of imported fuel, spare parts and technical assistance for operation and servicing. Sometimes, only the finishing touches of the production process are carried out locally (such as the rolling and bending of bars from imported steel or the mixing of paint from imported chemicals). For instance, in the United Republic of Tanzania, it has been estimated that 57 per cent of the cost of locally produced cement is made up of imported components, while, in the local production of reinforcing steel, rails, asphalt, electrical goods and roofing sheets, all raw materials and components are imported. 2/ A similar situation prevails in Sri Lanka where between 50 and 100 per cent of raw materials for building materials are imported. 3/

Thus, local production of modern building materials in developing countries has generally amounted to little more than the substitution of one kind of imported material for another, using imported inputs and technology, with the minimum use of local labour and/or development of locally available raw materials. The consequent dependence on developed nations suppliers consumes scarce foreign exchange to the extent that there can be a collapse of the industry when these resources are no longer obtainable. In the United Republic of Tanzania, shortage of foreign exchange has led to restrictions on the importation of materials, components and equipment for the construction industry and raw materials and machinery for the building materials industry, resulting in run-down of production. "Consequently, the rate of inflation in the construction sector is now estimated to be in the order of 50 per cent per annum, with many projects now grinding to a halt - either through lack of essential inputs, or through lack of funds." 4/ A similar situation obtains in many other countries, particularly in certain small countries in Asia and Africa which are part of the group of Least Developed Countries. Building materials production plants which depend on imported inputs, using scarce foreign exchange, tend to operate at considerably less than optimal capacity and therefore affect the prices of products and in turn severely limit the prospects of market expansion. 5/

There is a need for wide-scale production and adoption in developing countries of low-cost building materials, using minimal amounts of capital and foreign exchange - that is, for the production of building materials for which the raw materials and other inputs are locally available. In several developing countries, a substantial amount of the building materials that are utilized for the production of basic shelter and related infrastructure in rural as well as urban areas, are produced by small-scale units, often using indigenous resources which are cheap and abundant. The production of building materials based on such small-scale units sometimes meets all the needs of small-scale private developers in rural trading centres and peri-urban areas, not only for shelter but also for structures which are used as workshops, commercial cooking areas, market stalls, kiosks, private clinics, restaurants, day nurseries etc. 6/ In some instances, small-scale production of lime and aggregates and the extraction of sand or laterite, for example, have contributed immensely to the construction of civil engineering projects. In so doing, these small-scale units satisfy a market which the large-scale modern sector activities and materials, because of their high cost, fail to do.

Characteristically, some of the small-scale building materials production units operate in rural and urban areas, often unregistered and with their activities not enumerated in governmental records. They are part of a complex network of activities which have been conveniently termed the 'informal sector'. There are several limitations facing small-scale building materials production units in the informal sector, but their demonstrated ability and potential contributions are more significant. In fact, it is the thesis of this report that if appropriate

measures are promoted, building materials produced by the sector, in addition to providing the basis for the bulk of low-cost shelter, could be used in non-residential and civil engineering construction in the formal sector, so that they could have a significant impact on the task of developing indigenous building materials, based on principles of self-sufficiency and import substitution.

Chapter 1

THE CONTEXT OF SMALL-SCALE BUILDING MATERIALS UNITS IN THE INFORMAL SECTOR

Definition and scope

Small-scale production units are frequently taken to mean plants with less than a specified number of employees (generally 30 in industrial censuses). The number of employees alone is however, not sufficient as a criterion since it could, for instance, lead to the inclusion of such diverse operations as a fully-automated quarry producing several hundred tons of aggregate per day. Other indicators, notably the volume of output and the size of investment in terms of capital and/or equipment, should therefore also be considered as criteria in a division of activities according to scale.

Small-scale building materials production units would, by definition, have few employees, little capital investment and a very limited volume of output, and are very likely to show other characteristics, such as production with locally available raw materials, production for strictly local markets (because of the small volume of output and high transport costs of heavy low-value building materials) and intermittent levels of production (because of flexibility in production owing to low investments and fluctuating markets). For these reasons, the term 'small-scale production' has become a synonym for labour-intensive, low-cost, intermediate technology or traditional production. It is not size that differentiates the levels of production units but rather the nature of the resources required and the capacity to obtain them. This is illustrated by the definition of small-scale industries given in an Act of Parliament by the United Republic of Tanzania which "defines a small industry as any manufacturing unit whose control is within the capability of our people, individually or collectively, in terms of capital and the required know-how". 7/

In the informal sector, small-scale building materials production can be defined by the same criteria as other economic activities in the sector. Thus, entrepreneurs can initiate investments with relative ease, production techniques are labour-intensive, enumeration, accountability and other bureaucratic procedures of governmental agencies are often ignored, levels of skills are low, and there is hardly an expectation of re-investment for business expansion. 8/ However, unlike some types of informal sector activities which can be classified as marginal to economic development, small-scale building materials production and other construction and manufacturing activities in the informal sector play a significant role in economic

development, as will be illustrated in the latter part of the report.

In fact, the distinction between the formal and informal sectors, when related to small-scale building materials production, is only arbitrary, since in both cases the same factors of production prevail. For instance, access to loans is a constraint for both (even though the informal sector has an advantage through traditional credit systems), basic inputs are often purchased from the same source in the formal sector, markets are limited owing to low volume of output, quality of output remains unspecified (since government regulatory mechanisms are usually ineffective in this field), backward and forward economic linkages with other sectors are strong, and there is general scope for expansion of production to fill marketing gaps. Therefore, the real situation is more accurately seen as a continuum of activities passing through several levels of informal production and merging into the formal sector.

If there is at the moment any precise distinction between small-scale building materials production in the informal sector vis-a-vis the formal sector, this is perhaps most accurately defined in terms of types of finished products. For example, glass, cement, nails, asphalt, plastics etc. are generally produced in the formal sector, while lime, pozzolana, bricks, tiles, concrete blocks, thatch roofing, stone and fibre-cement roofing tiles are commonly produced in the informal sector. The following examples may help to illustrate the nature of small-scale building materials in the informal sector.

Examples of small-scale building materials production

In the western part of the island of Java, Indonesia, locally occurring limestone is used for the semi-industrial production of lime in vertical brick kilns made from local materials, using firewood for fuel. Natural pozzolana from the area is extracted by hand, sieved and mixed with the lime (five parts of pozzolana to one of lime) to make blocks of lime pozzolana, known as batako. Small units making these blocks employ between 1 and 10 workers each, producing between 200 and 300 blocks per worker per day. The use of lime-pozzolana mixtures in Indonesia is traditional - dating back to the eighth century, at least, when a number of temples were built using lime-pozzolana mortar. Modern production emerged in the 1970s, following the initiatives of the Bandung Housing Research Centre (DPMB). This organization has undertaken a considerable amount of research to improve the quality of the product. It has defined the proportioning of lime, pozzolana and water, and the curing conditions for improved mechanical resistance of the blocks. It has also developed manual pressing-machines and mechanical vibration-moulds for the production of hollow blocks (an innovative material), and it has also developed programmes for the training of local craftsmen in these production techniques. Consequently, today both solid blocks, made by hand in simple moulds, and hollow blocks, made in semi-industrial units with manual pressing-machines or mechanical virbation-moulds, are produced by numerous small enterprises for sale on the open market. The former (solid blocks) are sold mainly

to small subcontractors and self-builders in the immediate locality. The latter (hollow blocks) are also sold in Jakarta and Bandung, and at prices 20 to 25 per cent lower than concrete blocks of the same size. [9]

In Colombia, there are many small-scale production units, located in a clay-soil area at the periphery of Bogota, known as Los Chircales, where clay products (bricks, clay pipes, tiles etc.) are manufactured. Landowners divide their property into lots of 300 to 600 square metres for rental to prospective investors. The investment required to commence production of bricks etc. is minimal, and most of the inputs required for production, notably a dwelling unit for the operator, a mill for mixing the clay, tools such as shovels, pick-axes and wheelbarrows, and the kiln which is usually constructed from bricks and fired by local timber - are obtained from locally available resources. One main item of investment is capital for the payment of wages for the labour force or, in cases where only family labour is used, money for subsistence until the products can be sold. Unskilled labour is the main input to the production process, and, with minimal investments in equipment, techniques are essentially manual and therefore contribute to low productivity. The manual techniques, small capacity of the kilns and low levels of skill lead to low volume of output and low quality of product, so that the market is predominantly for the self-build housing activities of the low-income inhabitants of the area. Nevertheless, bricks produced in this manner accounted for 11.7 per cent of the total production of bricks in Bogota in 1972. [10]

Building stone is produced in many parts of Kenya, particularly on the outskirts of Nairobi and near some small towns. Methods of production are 'primitive', [11] and the only sophisticated operation is blasting to loosen the rock (even this is not always necessary, as sometimes the rock is loose enough to be simply dug out by hand). This operation requires some technical knowledge, as well as purchased inputs, such as explosives and hand-drills, but many producers overcome this barrier by hiring the services of a blaster from the Nairobi City Council or the Prisons Department. The rest of the production process consists of the cutting and subsequent dressing of the stone into blocks of various sizes which are then sold in 30 cm. lengths. These processes are carried out entirely by manual labour with the aid of a few simple tools, and even the measuring is done without any equipment. The skills required are fairly simple - dressers can be trained on-the-job in a few months, and, although cutters take longer to train, far fewer of them are required. Thus, the level of technology in the production of building stone is low, capital investment is practically nil, and the only substantial input is unskilled and semi-skilled labour, the returns to which represent about 80 per cent of the total costs of production. It is therefore very easy to enter the industry and to expand production by opening new quarries. Quarry operators are usually not the owners but concession holders who may be very small-scale or part-time operators, relying mainly on family or seasonal labour. In a few cases, they might be substantial firms with more or less continuous operation and a permanent labour force of as many as 20 men. In general, wages are comparable with those of unskilled workers in other sectors of the economy and higher than those in agriculture.

There are several other examples in developing countries that may help to illuminate the enormous range and variety of small-scale production units that currently exist in the informal sector. In the Philippines, traditional building materials, often cottage industries, produce bamboo, bricks and roofing materials, and operate on a substantial scale. 12/ Again in Indonesia, small-scale building materials industries, (mostly unorganized labour-intensive cottage industry) run in traditional ways in the rural and urban areas, producing clay bricks, tiles, cement products, lime, bamboo, timber elements, stone, gravel, sand and pozzolana-lime blocks. 13/ In Sri Lanka, small-scale and traditional production units, producing bricks, country tiles, sand and lime, supply more than 35 per cent, by value, of total building materials used in the country. 14/ In China, 80 per cent of building materials, including bricks, tiles, fly ash, sand and stone, as well as 64 per cent of the cement used in the country are produced on a small-scale by brigade and commune enterprises. 15/

Characteristics of small-scale building materials production units

The preceding examples of small-scale materials production, drawn from different parts of the world, show the great variety of productive units that exist - both in terms of the product itself and the process of production. Although, at first sight, they may appear to have little in common, they have a number of important common characteristics.

The evolution of the product and the technology

A number of materials produced in small-scale units may be 'traditional' in the sense that they have been produced for generations in the same manner, with very little change in methods of production, inputs or technology. However, surprisingly few materials produced today are entirely traditional. Modifications to traditional products are sometimes brought about by the decreasing availability of certain key inputs, such as firewood for fuel in the firing of clay bricks or the decreasing availability of clay itself, as in certain areas of China. At the same time, there has been an increase in the availability of other 'modern' inputs, such as simple tools and equipment for the working and transport of raw materials. In many countries, a number of completely new industries have developed, entirely dependent on modern materials - either new or recycled. Innovations in the product or the technology employed in production might be developed by the producers themselves or pioneered by official research institutes and then disseminated. Although those in the latter category receive the greatest publicity, there is substantial evidence that product innovation is constantly occurring in small-scale manufacturing units in developing countries and that a surprisingly wide range of technology, tools and equipment now exists - even in Africa, commonly regarded as the least developed region in technological terms. 16/

As a result of this constant evolution of technology, there is no clear dividing line between traditional and modern materials but rather a range from purely 'traditional' with no modern inputs to 'improved traditional' to 'conventional' (such as concrete blocks) and, then, to 'innovative' or entirely new products. Likewise, the durability of the product also varies from 'temporary' materials requiring constant repairs (such as mud-blocks, adobe or unburnt bricks) to 'semi-permanent' materials (such as kiln-fired bricks)* to 'permanent' materials (such as concrete blocks and stone). Again, no clear-cut division exists, as even temporary materials may be given a degree of permanence by the addition in small quantities of other key materials and/or subjection to additional processes - such as the addition of small quantities of cement to soil or the impregnation of bamboo. Also, there is no necessary correlation between the stage of evolution and the durability of the product, as some of the most traditional industries (such as stone-dressing) still produce the most durable products. However, despite this great variety in both the products and the evolution of the production process, the technology employed in all small-scale building materials units is still, by definition, simple. There is very little investment in machinery or equipment (what there is is in tools rather than machines), and the majority of processes are carried out by hand.

Inputs required for the small-scale production of building materials

The basic inputs required for the production of building materials include labour (skilled and unskilled), machinery, equipment, tools, finance, energy, land or premises, and means of transportation. Although these inputs are the same for small-scale and large-scale formal industry production, the mix of inputs tends to vary between the two systems of production. In particular, there is a general tendency for small-scale production units to be synonymous with low investments in plant or machinery. For instance, there is evidence that capital investment per worker is small-scale enterprises producing bricks is only 1 per cent of that required for large-scale production. 17/ A comparison of capital requirements for roofing materials shows that, in Sri Lanka, capital invested in the production of country tiles was less than 0.6 per cent of that required for the large-scale industrial production of galvanized iron sheets. 18/

In the informal sector,small-scale building materials production units tend to consume a range of inputs similar to those previously described, but sometimes these inputs are very peculiar to the sector. For instance, the requirement for land or premises may be fulfilled by illegal processes of squatting or manufacturing in residential premises. In place of conventional financial institutions, there are traditional credit systems, such as money lenders and family donations, which respond to the needs of investors in the informal sector. Training of skilled labour is largely by the apprenticeship system, often, in modified form, involving on-the-job training. Sometimes, extensive use of family labour (including children and females) is adopted, so that this component of hidden costs is reflected in a reduction of final cost of building materials.

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*As produced in the informal sector.

Where the production process involves the use of machinery and tools, there is often dependence on locally produced equipment and where imported machinery is installed, attempts are often made to provide innovative solutions to the problems of spare parts and maintenance, since there is usually little likelihood of obtaining imported spare parts. In fact, this level of inputs, for the informal sector, even applies to the transportation of raw materials and finished products. Here, the problem of lack of means of transportation, or high costs of transportation owing to scarcity of petroleum products, is minimized by the use of low-cost modes of transportation such as animal-driven carriers.

Markets for the products of small-scale materials units

The generally low level of skills required for the small-scale production of building materials as well as the low cost of labour and material inputs and, hence, the low level of capital required to start production mean that entry to the industry is relatively easy and certainly presents no insuperable barriers to the enterprising potential entrepreneur. Thus, the industry is highly competitive. It also means that costs, productivity, the quality of the product and the price charged for it are all relatively low (compared with the mass-produced products of modern industries), which could have an important effect on the market for the product.

There is evidence that the majority of products of small-scale building materials units, especially in the informal sector, serve the requirements of low-income populations in both rural and urban areas, who constitute the majority of households in developing countries. However, there are instances where products of this kind, such as concrete blocks or lime-pozzolana blocks, have been purchased by public sector construction agencies for governmental shelter and infrastructure development projects. In other instances, building materials and components produced in this manner have been purchased by high-income groups for shelter and non-residential construction, and this phenomenon is particularly significant when the formal sector production systems have collapsed so that the informal sector operates as the only source of production.

Scale, continuity and production modes

There are, in most countries, some relatively permanent small-scale producers of building materials with more or less continuous production, some degree of investment in fixed overheads (premises, equipment etc. and a relatively stable labour force. However, many more produce only intermittently, when they have orders and when their other activities permit. Some individuals might be permanent producers, in so far as they have been operating at the same place and producing the same product over a number of years, even though their production might be spasmodic or seasonal - as is the case with quarry-owners who integrate their quarrying activities with the agricultural cycle, so as to supplement their income as farmers. Others might regard the production of building materials as a purely temporary occupation - chosen because of the ease of entry - and might subsequently move on to other activities or back to previous occupations, as circumstances dictate or allow - such as new-comers to Bogota who might operate a chircal as a way of obtaining accommodation and, hence, an entry to the urban scene.

Thus, there is a wide variety of production modes in small-scale building materials activities - ranging from individual artisans, producing to order, perhaps with a number of apprentices, to self-employed individual producers or small family units, producing commodities for sale on a seasonal, temporary or permanent basis (known as 'petty-commodity producers') 19/ to small firms or capitalist enterprises with some accumulated capital, employing wage labourers on a more or less permanent basis.

Clearly, many of these units producing building materials on a small scale have come into being as a result of individuals actively searching out opportunities for the creation of employment or the generation of additional income to supplement inadequate existing earnings, as opposed to entrepreneurs with capital looking for profitable opportunities to invest. They fit well into a widely accepted definition of the informal sector 20/ as a productive, dynamic "intermediate sector, contributing to income and output, and capable of attracting and sustaining labour in its own right". 21/ However, such a definition is in contrast to another set of informal sector activities which have sometimes been termed the "irregular sector" or the "community of the poor". 22/

At the lowest level of informal sector production, entrepreneurs produce with high-priced inputs, supplied by modern manufacturing industry, but at the same time they are inclined to sell their products at low prices due to the highly competitive markets in which they operate. This tends to limit the possibilities for the expansion of demand for their products, leading to their being considerably constrained in their ability to accumulate capital for reinvestment and expansion, and, thus, in their ability to move on to a higher economic and technological plane. Also, their limited ownership of or access to capital means that they have very little 'economic muscle' to compete in the market place, so that they are highly dependent upon others - landlords, transporters and distributors. They are an 'exploited' as opposed to an 'exploiting' group within the national economy. 23/

As relatively permanent production units have succeeded, at least to some extent, in overcoming some of the constraints affecting other not so permanent units, they have made the transition from petty producers to capitalist enterprises. If the objective is to assist small unsophisticated units to emulate their successful rivals, (i.e.,to improve their technology and organization to reach a higher and more productive level than the prevailing one) in terms of producing in large quantities for an expanding market, any attempt to divide productive units into 'formal' and 'informal' sectors (or any other such division) and to confine discussion to one or the other of such subdivisions would clearly be counterproductive.

Chapter 2

CONTRIBUTIONS TO THE NATIONAL ECONOMY BY SMALL-SCALE BUILDING MATERIALS PRODUCTION UNITS

Contributions to the construction sector

In most developing countries, civil engineering works and non-residential buildings take a greater proportion of total construction output than shelter construction. Despite this disparity, residential construction is still a significant component of the construction sector, and it could be argued that, if official statistics were to account properly for the often - ignored residential activities in rural areas and urban low-income settlements, the ratio of residential output to civil engineering works and non-residential building would show an increase. Building materials and components which have been produced in the informal sector have contributed significantly to shelter construction in most developing countries, and the bulk of the population - usually the rural and urban low-income groups - has remained a captive market for the products of small-scale building materials units in the informal sector, so that a majority of houses built in rural areas and in the low-income settlements of urban areas are still dependent on this sector.

Although there are inputs apart from building materials required for construction output, residential construction amongst the rural and urban poor tends to have a higher proportion of building-material input than of other inputs. In fact, when residential construction is organized through self-build or community participation mechanisms, building materials and components are nearly the only inputs required. Far too often, shelter in rural areas and urban uncontrolled settlements has been seen as having only a social value, and any contributions to economic development have been marginally estimated in terms of value of inputs and value of fixed assets after construction. However, consideration should be given to the fact that, in rural areas and urban slums and squatter settlements, the house can operate as a factory after construction, providing shelter for commercial food preparation, repair and maintenance of vehicles and machinery, manufacture of tools, building materials etc., services such as laundries, and a host of other economic activities which are still meaningful even in the context of industrial development. To this extent, small-scale building materials units in the informal sector and, by implication, shelter for the rural and urban poor will continue to play a significant role in the construction industry of most developing countries.

Contributions to the lessening of import dependence

Faced with declining markets for their exports (both traditional and non-traditional) and burdened with the repayment of foreign debts, one country after another is being forced to pursue an austerity programme- in some instances, foreign exchange resources are not even sufficient to meet the basic food needs of the population, let alone provide for the requirements of industrialization and economic growth.

"If capital goods are produced domestically then there need be no foreign exchange restriction of this kind on the rate of growth of output ... with stagnant foreign exchange earnings, a strategy of industrial growth should be adopted which is biased towards the production of capital goods". 24/

It is in this context that the expansion of small-scale building materials production units must be considered, since they have demonstrated their contributions to the lessening of import dependence in at least two basic ways. First, the production and utilization of indigenous building materials and components, such as lime, pozzolana, soil-cement blocks, lime-pozzolana blocks, clay tiles and thatch roofing, have contributed to the reduction of demand for imported substitutes. Secondly, the informal sector has demonstrated its capacity to use a large proportion of inputs which are locally available, and, even where imported inputs are used, they can often be sustained without dependence on imported spare parts.

Contributions through economic multiplier-effects

Production of building materials in the informal sector provides additional benefits to national development in terms of backward and forward linkages in the economy. The consumption of building materials which are produced in this manner, not only for the shelter requirements of the rural and urban poor but to a small extent for formal sector residential, non-residential and civil engineering works, contributes to the economic performance of other sectors of the economy, notably agriculture, industry and transportation. In addition, the spin-off effects from expenditure on construction activities can be retained within the national economy, as opposed to the current 'leakage' which occurs through the use of substantial quantities of imported resource-inputs for construction projects. In the United Republic of Tanzania, it is estimated that the value of potential benefits, in terms of multiplier effects which are being currently lost, stands at 75 per cent of construction expenditure. 25/

Small-scale building materials production units in the informal sector consume a high proportion of intermediate inputs in the production process, generating backward linkages of significance to the national economy, as a large proportion of inputs is consumed from other economic activities in the informal sector - for example, the repair and maintenance of vehicles and machinery, the manufacturing of simple tools and equipment such as pick-axes and wheelbarrows, transportation of raw materials and finished products often by low-cost modes of transportation, and the purchase of raw materials such as sawn timber. Apart from creating links within the informal economy, building materials production in the informal sector depends to a large extent on inputs from the formal sector, notably of fuel consumed in the production process and chemicals, adhesives, tools and machinery.

What is more, a large proportion of local production of building materials takes place in rural areas. This has important implications not just from the viewpoint of equity but, even more importantly, for

the effect that it can have on the generation of employment and the expansion of commodity production in the countryside. This process can further the achievement of national integration and economic growth.

Contributions to employment generation and income redistribution

The nature of building materials production in the informal sector is such that it is largely a labour-intensive operation, with unskilled labour accounting for a substantial proportion of all the factors of production. In brickmaking, for example, the labour requirement for the production of 10 million bricks per annum ranges from 160 men in small-scale traditional units to only eight in a modern, highly automated factory. Hence, small units use 20 times as much labour as large units for the production of the same volume of output. 26/ Ganesan's comparisons of productin characteristics in different types of industries present a similar picture. In a comparison between different types of roofing materials, it was found that 960 workers were required for the production of country tiles as against only seven for an equivalent output (by value) of g.i. sheets. Thus, traditional small-scale units producing country tiles employ 137 times more workers than the least labour-intensive process for the production of roofing materials. 27/

The employment-generating potential of investment in small-scale building materials units can hardly be denied. Doubts may perhaps legitimately be raised about the quality of such employment, for frequently, employment generated with little capital investment is relatively 'unproductive' and thus yields low returns for long hours of labour. A number of recent studies of the informal sector have shown, however, that investment in those enterprises engaged in manufacturing, as opposed to trade and services, not only generates employment but also yields substantial output - in which case the employment generated cannot be said to be unproductive.

House, for example, has estimated that investment of K.Shs. 1 million* in the informal manufacturing sector in Nairobi would yield 5,500 jobs and K.Shs. 2,250,000 of output, compared with 500 jobs and only K.Shs. 744,000 of output from a similar investment in the formal sector. 28/ Such evidence adds weight to the findings of others that, although wages paid to employees in informal-sector enterprises show considerable variations, the returns to employees are frequently well above the levels of wages paid in the formal sector. 29/ This would appear also to be the case for enterprises in rural areas, where small-scale manufacturing firms in the 'intermediate sector' give better-than-average incomes for their owners, a higher rate of return on capital than in the 'formal sector' and wages comparable with those earned in the 'modern sector' and better than those in commercial agriculture. 30/

*U.S. $1 = Approx. 14.25 Kenya shillings, (1984 rate)

Unlike certain activities in the informal economy, such as trading, hawking and peddling, building materials production generates not only employment and income-earning opportunities but, equally important, skilled manpower which can easily be adapted to other sectors of the economy. Skill generation is achieved in two ways. First, skills are generated in the process of producing materials, such as clay bricks, tiles, timber components and iron-mongery, and, secondly, skills are obtained as a consequence of utilizing these building materials in the construction sector.

The effect of the creation of additional employment opportunities among unskilled and semi-skilled workers would be a redistribution of income nationally in favour of low-income wage-earners or poor sections of the community. This, in turn, would generate additional demand for the goods and services purchased by these groups - which are mosly, of course, the goods and services produced by the low-income earners themselves. Hence, the multiplier effects generated by the creation of additional employment would, to a very large extent, be retained within low-income communities, serving to reinforce their redistributive effects.

Potential contributions to economic development

There is considerable experience to show that a range of building materials produced in the informal sector can be reasonable substitutes for those produced in the formal sector, especially by large-scale production systems. A typical example is the replacement of Portland cement by lime, pozzolana and gypsum as binders. In road construction programmes, it is possible, for instance, to use lime in stabilizing soil, instead of cement. Formal sector residential and non-residential construction projects can benefit from the use of soil-cement or lime-pozzolana blocks and country clay tiles, following the examples of Indonesia and Sri Lanka. 31/ Most economies in the developing countries cannot sustain formal sector systems of production, so that there is a latent demand of informal sector products which could meet output requirements and contribute to the achievement of self-sufficiency and import substitution in building materials production. No doubt, when these potential benefits materialize, there will be a great contribution to economic development in terms of employment generation, skill generation, income redistribution and, in general, economic multiplier-effects which will stimulate growth in other sectors of the national economy.

Chapter 3

CONSTRAINTS TO THE PRODUCION OF INDIGENOUS BUILDING MATERIALS IN THE INFORMAL SECTOR

Quality of products

The quality of building materials produced in small-scale units is generally thought to be low and, hence, an obstacle to the expansion of their use. This is not necessarily the case. For example, bricks produced in traditional brick industries have been used in the construction of buildings that have stood, without repairs, for many years. 32/ Also, building stone, produced frequently in small-scale units, is a durable, high-quality and highly regarded building material throughout much of the world - a fact generally reflected in the high prices it is able to command in a number of countries. Nevertheless, materials produced by small-scale units are widely believed to be of low quality.

There might be a number of reasons for this. First, some materials produced on a small scale do have very short lives: these are generally non-durable or temporary materials, such as adobe, bamboo, wattle, thatch and mud-blocks. Structures built of such matter materials require constant repairs, and while this may not be a serious disadvantage for nomadic peoples or settled communities in the countryside where the materials are freely available, it clearly is a disadvantage in urban areas or for people in employment who do not have the time required for house repair. These materials, however, are used, because of their low cost, by the lowest-income-earning sections of the community, so that, in the short term, they have a very important role to play. 33/ Moreover, technical innovations have been developed that could extend the life of some of these products, perhaps by a substantial margin. Secondly, some other products of small-scale building materials units, although they might have a longer life than the purely temporary materials just mentioned, might be generally deficient in terms of strength or other physical properties (such as porosity or the degree to which they are susceptible to erosion) and, thus, frequently lacking in durability also. In the case of bricks, this could be a result of inadequate firing, that is,inadequate time and temperature in the kiln which means that the ceramic properties are not properly developed and that the bricks have performance characteristics closer to those of mud blocks. 34/ Similarly, lime produced in a traditional 'beehive' kiln might be of lower quality than the product of a modern kiln, 35/ and cement blocks moulded and compacted manually might have less strength than similar products made in vibrating machines. Perhaps, even more important than general low levels of quality is the fact that quality is frequently highly uneven. As testing facilities are seldom available to small production units (that is, there is no quality control), this can present problems in the construction process. It generally results in over-specification, in order to compensate for the possibility of uneven quality. Finally, building materials produced in small-scale units might be considered inferior in quality when they are made essentially by hand, so that they lack the even appearance and exact dimensions of their machine-made substitutes. This can result in additional work being required on the building site,

such as the final dressing of rough-cut stone or the rendering of brick or blockwork to obtain an acceptable finish.

There are two reasons why problems of low-quality production persist in the informal sector. The first is related to certain characteristics of the informal sector, such as the low levels of skills, ignorance of correct production procedures and fraudulence as exemplified in attempts to minimize the use of cement in concrete blocks at the expense of safety factors etc. The second, which is applicable to the formal sector as well, is that, for a majority of indigenous building materials produced in the informal sector, standards, specifications and testing procedures are yet to be formulated, documented and administered as part of government regulatory procedures. Building codes and regulations in most developing countries ignore the prevalent use of materials from the informal sector, thereby failing to provide any mechanisms for sustaining or improving the quality of products.

There is evidence that crippling restrictions have been lifted in a number of countries - for example, the removal of restrictions on the use of soil-cement blocks in Ghana. Although a great deal of time and effort is required to produce revised regulations and specifications based on appropriate standards and norms, it has been done in a number of countries, frequently with some international support. 36/ However, the problem then arises of ensuring that revised regulations are adopted and enforced. In this connection, it is useful to remember that building regulations and specifications are only guidelines- what is critical is how they are applied in practice. Since all important decisions affecting the use of materials in construction are taken at the design stage, application of indigenous building materials will depend to a very large extent on the training, background and attitudes of designers. Thus, changing regulations alone will achieve nothing, unless the current bias of designers towards modern, sophisticated, highly capital-intensive products and processes is also changed.

Lack of basic inputs

As already mentioned, the basic inputs required for the production of building materials are common to both the formal and informal sectors. However, it is the nature of constraints relative to these basic inputs, singly or collectively, that defines the peculiarity of the informal sector. In general, unskilled labour is in plentiful supply in the vast majority of developing countries and, therefore, presents no problem. The requirements for skilled labour obviously vary in accordance with the nature of the production process, but in the building materials industries as a whole, it is generally true to say that the skills needed are minimal and can be easily acquired through on-the-job learning. There is now considerable evidence pointing to the fact that the 'informal sector' of the economy and, in particular, the 'intermediate' sector of small-scale manufacturing enterprises serve as a significant training ground for industrial skills.37/ Sometimes, skilled manpower deficiencies

are discovered with the introduction of innovations in either products or production processes. In these cases, some technical inputs, from external sources, might be required, and these might take the form of the loan of key items of equipment or key personnel for the demonstration of and/or the provision of training in the new technique.

If the informal sector, enterprises are limited in their operational efficiency, owing to low levels of managerial skills. While this might not be a crucial factor for relatively simple activities, it certainly is vital for manufacturing and building contracting activities, since these are so much in interaction and competition with their formal sector alternates who clearly have opportunities for improving their management techniques. Related to building materials production in the informal sector, lack of managerial skills has contributed to many problems, such as lack of forward planning to offset shortages in basic raw materials, unfavourable procedures for marketing of products and general difficulties in penetrating formal-sector markets.

There appears to be fairly widespread agreement among those who have undertaken research in the informal sector that small-scale manufacturing enterprises are constrained in their ability to acquire a number of vital inputs, particularly key raw materials, energy and tools. This is particularly a result of the weak bargaining position of such enterprises in obtaining access to capital vis-a-vis the large scale firms which generally control the supply. Small firms frequently have to purchase vital inputs from large powerful organizations at prices largely determined by the latter. In the process, a certain amount of surplus is transferred from small to large enterprises, contributing to the 'exploitation' of the former by the latter and inhibiting the ability of the small enterprises to accumulate capital on any significant scale. 38/ Such a situation is less likely to arise in those industries which make a little use of scarce modern sector inputs, such as those producing bricks or quarrying stones. It should be noted that governments frequently reinforce this general inequality in access to resources, especially foreign resources, by favouring large firms, for no other reason than that they are vocal, visible and easy to deal with.

As previously mentioned, the majority of small enterprieses in developing countries have no access to formal sources of capital or credit but are forced to rely upon the savings and borrowings of family and friends. While, in many ways this provides a source of strength for the enterprises themselves (in so far as costs are kept down by the absence of heavy interest payments on loans) and for the economy as a whole (in that it forces the mobilization of domestic sources of capital), it also has many serious negative effects. Apart from leading to problems in the procurement of vital inputs, as discussed before, a shortage of capital means that producers are unable to finance the building up of stocks. As many of them can produce only in small quantitites and are unable to expand their output rapidly in response to sudden increase in demand, this has serious repercussions on the prospects for successful marketing and the expansion of production in the long term.

Thus, capital shortages force small producers to operate as sub-optimal levels of output and employment, and because of difficulties in procurement and marketing, there is an increase in the dependence of small enterprises on large-scale firms or, even, a tendency to force the subordination of the one to the other. 39/ For these reasons, the lack of access to capital must be regarded as the most serious constraint, in terms of inputs, to the expansion of the activities of small-scale manufacturing units.

Actions by governments which favour loans to the large-scale sector need not be deliberately discriminatory, since they might simply be a reflection of the genuinely higher risks involved in lending to small organizations with little or no collateral rather than to large ones. They might also reflect the higher administrative costs of handling a large number of small loans rather than a few large ones. Whatever the reasons, there is evidence from a number of sources that government credit schemes, whether designed for small business in general, for small rural industrial enterprises or for small firms operating in a particular sector of the economy, have generally not been very effective in meeting the needs of the small enterprises they were intended to serve. 40/

Markets

The main market for informal sector building materials is found among the low-income sections of the population who purchase these materials directly for the construction of their own houses or indirectly through the small-scale indigenous contracting industry. However, some significant percentage of certain materials, such as building stone, might find its way into the 'formal' contracting industry. It is a common assumption that the products of the small-scale manufacturing sector in general are regarded as inferior goods even by the low-income groups whose needs it serves so that prospects for market growth are limited. Therefore, an increase in the incomes of the low-income population, on its own, might not lead to an increase in demand for informal sector products, unless such products become competitive with large-scale products in terms of quality and variety. In fact, there is evidence that as their incomes rise, people tend to purchase goods from the large-scale manufacturing sector rather than the informal sector, and this is true even at very low levels of income. 41/

It is a fact that, at certain levels of income, many consumers prefer to build their houses with the products of large-scale, capital intensive industries - as is evidenced by the ubiquitous appeal of cement blocks, modern windows and galvanized iron (g.i) roofing sheets. A similar situation can be observed with non-residential buildings, whenever the availability of resources permits - as is the case when governments or large private sector organizations are the clients. With increases in incomes among the population as a whole, 'market constraints' or blockages to expansion might develop for the informal sector as a result of preference for transfers to large-scale, capital-intensive production outputs.

Modern mass-produced materials such as concrete and galvanized iron, not to mention steel, glass and plastics - are obviously durable, strong and generally efficient in the functions which they are designed to perform. Thus, they do keep out the rain, the cold or the sun very effectively and for many years without repairs, so that few other materials can challenge them in either effectiveness or 'cost-in-use'. Consequently, the choice of these products may be entirely rational from the consumer's point of view, as long as they continue to be available at prevailaing market prices.

Technologies

Some building materials cannot easily be improved without significant increases in costs. However, many materials can be improved with little or no increase in cost or, in some cases, with even with a cost reduction. Much research work has been carried out during the past 20 years, both in developed and developing countries, into the possibilities for improving production techniques of building materials used in the informal sector. Many such technological innovations have been designed to improve the durability or strength of the basic material, such as techniques for the impregnation of bamboo and the stabilization of soil by the addition of small quantities of various types of stabilizers or the development of an 'insulator' kiln to improve the reliability of the firing process for bricks. Other innovations have been designed to reduce the quantity of materials required in certain products and, hence, the cost, such as the introduction of new types of moulds for the production of hollow blocks, which should result in lower transport costs and faster speed of erection on-site owing to the lower weight obtained. Technologies have also been developed for the use of reclaimed or recycled materials such as the use of fly-ash, reclaimed concrete or ground broken bricks as aggregates in the mixing of concrete. Finally, new uses have been found for existing materials, resulting in new products suitable for production on a small scale using manual processes, e.g., the development of fibre-reinforced concrete for roofing sheets and tiles.

Very few of these developments, however, have progressed beyond the laboratory or the construction of one or two prototype or demonstration units. While it is commonly supposed that the barrier to the acceptance of innovations of any product by small-scale producers is simple conservatism and inertia, there is some evidence pointing to the fact that this is not necessarily the case. There may be sound reasons for the failure of small entrepreneurs to adopt new techniques and/or develop new products. One of these is that all the risks of producing a new product or adopting a new technique fall upon the producers, and, with few resources available to them, many simply cannot afford to make mistakes. Furthermore, they often lack the necessary capital and/or foreign exchange resources required for production, especially in view of the fact that new technologies often need high technology to produce tools and equipment.42/ Finally, they cannot be sure that the product, if it is a new material or component that is being produced, will be accepted by clients.

There are two other constraints, closely related to the above, that have created barriers to introducing and replicating technologies, especially with regard to the production of new indigenous building materials in the informal sector. First, attention to customer needs, especially since supplementary skills are required for the use of new materials, is particularly important. In the case of fibre-cement roofing components, it has been suggested that the market should initially be served under 'supply-and-fix' arrangements, so that the customer can be provided with a finished roof rather than a consignment of unfamiliar components which might be misused, leading to trouble.43/ It should be noted that fibre-cement technology has progressed since this was written, but the general injunction that the customers/users of new building materials need help, as well as the manufacturers, is worth bearing in mind. In Parry's words:

> "Once significant resources of know-how and skill in handling the products have been accumulated by local artisans in the building trade, then the general introduction of the products can begin without special restrictions".

The introduction of a new product based on a new technology inevitably gives rise to changes in other areas of the system of which it is a part, and a systems approach should be adopted by the sponsor/propagator of new technology, in order to ensure that it is fully understood and accepted by producers and clients/customers. Failure to understand this requirement might be a factor in the phenomenon of frequent experimentation but few fundamental advances in low-cost building materials production.

A second factor in the failure to carry technological innovations through to the stage of widespread replication is the lack of accepted product standards. The construction industry is highly conservative in its approach to new and modified building materials, partly because of the long life expected from the final products and partly because of the separation of responsibility for design from the responsibility for physical construction. Far from favouring small-scale manufacturers, construction standards and specifications frequently favour large-scale producers, owing to the difficulty and cost of obtaining approval for new or modified products. The costs of laboratory and field trials to secure acceptance by standards institutions and other regulatory bodies are formidable and could not be contemplated by individual small-scale producers. A further difficulty is the lack of simple and agreed methods of quality control and inspection to give a guarantee of adequate performance in use.

In the case of lime-pozzolana, the lack of accepted standards is a great constraint, and consideration has been given to limiting its use to the manufacture of concrete blocks, so as to minimize this problem and prevent the possibility of misuse as a Portland cement substitute. The case of improved small-scale brickmaking presents a contrasting problem, since the new product is distinctly superior to the traditional slop-moulded brick. Although its ex-works price is higher than that of the traditional brick, its

cost-in-use is lower, since external rendering is unnecessary and maintenance costs are minimal. If an appropriate product standard was available and adhered to by all operators of the improved technology, it would thereafter be possible to create a market based on the twin attractions of improved quality and low-cost. The fibre-cement roofing tile has already shown its worth in trials, but again it is not possible for individual small manufacturers to finance extended acceptance trials that would be a prerequisite to widespread specification by national clients, sucha as housing corporations.

While it is understandable and correct that standards institutions should be extremely cautious regarding the acceptance of new materials, particularly in structural applications, a degree of flexibility is essential to enable new and modified low-cost materials to find their way into the market-place without the excessive cost and time required for extensive field trials. A strong case may, therefore, be made for applying a less extensive and less expensive testing and approval procedure to low-cost, non-structural building materials and components than is demanded of items that are to be applied in multi-storey buildings or other structural uses. The introduction of a two-tier regulatory system need have no adverse effect on safety but would enable new materials to make an impact on the desperate need for affordable housing and other forms of shelter.

Chapter 4

MEASURES TO INCREASE THE CAPACITY OF BUILDING MATERIALS PRODUCTION IN THE INFORMAL SECTOR

It has been established in this report that small-scale units producing building materials in the informal sector of the economy are capable of satisfying the building materials requirements for the provision of shelter and basic infrastructure for the rural and urban poor. They could, therefore, also make a significant contribution to the development of the national economy, both indirectly through the creation of an indigenous low-cost construction capacity and directly through the effect of expanded production in employment and income generation, especially in the rural areas. However, these benefits have yet to be achieved, owing to the persistence of constraints which could be minimized if certain measures are adopted. The following measures should be of interest to international agencies in their support of national governments to find ways of developing building materials production in the informal sector, so as to increase its contribution to national self-sufficiency and import substitution.

National governments can promote an increase in building materials production in the informal sector by providing support in various ways.

Supply of basic inputs

The constraints faced by entrepreneurs in the informal sector of building materials production in obtaining basic inputs, such as land, finance, training, tools and transportation, can be minimized if governments focus on:

(i) Providing incentives to entrepreneurs by reducing import duties on basic machinery and extending tax concessionsto new entrepreneurs in "high-risk"building materials production units;

(ii) Minimizing the initial cost of land, premises and basic infrastrucutre, by renting serviced plots and premises to entrepreneurs for a reasonable remuneration;

(iii) Providing favourable fiscal policies to strengthen traditional and informal sector credit institutions, through direct investments in seed capital and adjustment of interest rates;

(iv) Providing managerial on-the-job training to selected groups for wide-spread replication in the sector;

(v) Ensuring flow of information and opportunities for participation in public sector-sponsored workshops, etc. in the field of technology application.

Support for research and technological development

Governments can improve productivity as well as close the gap between research findings and wide-scale adoption of such findings by:

(i) Undertaking demonstration projects jointly with established informal sector producers;

(ii) Disseminating information on improved production methods;

(iii) Providing on-the-job training on new findings related to production.

Promoting standards and specifications and other regulartory measures for the improved quality of products

The problem of low quality of informal sector products, which tend to limit their durability and wide-scale utilization, can be minimized through governments:

(i) Undertaking the formulation and documentation of appropriate standards and specifications for the production and utilization of indigenous building materials used in the informal sector, such as thatch roofing, bamboo, reeds, stone, adobe, stabilized soil, lime pozzolanas and gypsum;

(ii) Disseminating information and demonstrating methods of applying such standards and specifications in the production process;

(iii) Using competitions as incentives, to encourage the optimal use of improved materials and other resources.

Promoting informal sector organizations

Trends in the formation of organizations in the informal sector do exist, and governments can promote this development so as to provide an efficient mechanism for assisting the sector. At the same time, such action can form the basis for "self-help" development. In this regard, attention should focus on:

(i) Providing logistic and organizational support for the associations;

(ii) Channelling the supply of basic inputs to the sector through such organizations;

(iii) Organizing purchases of building materials from the informal sector for specific government projects or other forms of formal construction activity;

(iv) Utilizing informal sector products in specific government-sector construction projects.

Appropriate shelter policies for the low-income population

Governments can stimulate and sustain an increase in supply capacity indirectly by promoting shelter programmes which favour the requirements of the low-income population. Focus could be on:

(i) Implementing self-help and community participation shelter programmes, using resources available in the informal sector;

(ii) Establishing and strengthening housing finance strategies which assist low-income groups to acquire materials produced by the informal sector.

Appendix

CHARACTERISTICS OF VARIOUS TYPES OF BUILDING MATERIALS PRODUCTION PROCESSES

Capital requirements worker

There is evidence to show that small-scale informal units producing building materials require substantially less capital investment than industries producing on a large scale the same amount of output. An analysis of the capital requirements for the production of bricks using alternative technologies is shown in table 1.

Table 1. Capital and foreign exchange cost of brickmaking

Process	Total Capital cost/10m p.a. ('000 US.$)	Percentage of cost imported	Local
Small-scale traditional manual process	34	5	95
Small-scale intermediate technology	578	15	85
Mechanical plant with Hoffman kiln	3880	75	25

Source: J.P.M. Parry, "Technical Options in Brick and Tile Production", paper presented to Intermediate Technology Workshop, Birmingham, 1983

It is clear from table 1 that the capital required for a large mechanical plant with a Hoffman kiln is more than 100 times that required for a small-scale, traditional manual brick-making unit to produce 10 million bricks per annum.

Additional evidence of the capital requirements of traditional small-scale production, as opposed to large-scale building materials industries, is provided by Ganesan in his various studies of the industry in Sri Lanka.[1/] This is presented in tables 2, 3 and 4.

From table 3, it can be seen that the capital required per worker, * in traditional production units as a group, ranged from Rs. 400 - 2,000, which compares very favourably with a requirement of from Rs. 9,800 to 217,000 in modern industrial units (i.e., the large and modern units may require up to 500 times more capital). Disaggregating this information to the level of individual industries, table 3 shows that capital requirements per worker range from a low level of Rs.400 for the production of sand and cadjan, Rs.500 for country tiles and Rs. 700 for bricks, to high levels of Rs.93,000 for the production of steel. Even more interesting, table 4 shows a comparison of the production characteristics of different types of roofing materials, that is, materials which could potentially provide substitutes for each other. The capital required per worker ranges from Rs.500 for the production of traditional country tiles, to Rs.82,000 for the modern industrial production of g.i. sheets.

Additional support for these figures can be found in some of the literature now available on the informal sector. Thus, Bose, found that the capital invested per worker in the informal sector in Calcutta was only 16 per cent of that in large formal sector enterprises in the same city. Sethuraman, from a number of studies sponsored by ILO, noted that the capital required per worker in manufacturihg activities in the informal sector was everywhere much the same - between US $200 and $350.[2/]

Foreign exchange requirements

Small-scale building materials production units not only require less capital than large plants but also require considerable less foreign capital - both in terms of initial installation and operating expenses. This is demonstrated by the information presented in tables 1, 4 and 5. From table 1, it can be seen that the imported component of the capital costs of brickmaking in small manual units is only 5 per cent of the total capital cost, compared with an import-component of 75 per cent of the capital costs for a large-scale mechanical plant with a Hoffman kiln.

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*US$1 = Approx. 9 Sri Lankan Rs. (1975 rate)

1/ Ganesan (1982).

2/ Sethuraman (1984).

Table 2: * Comparison of labour intensity, capital intensity and machinery and tools used per worker etc. in building materials production in Sri Lanka (1973 values)

Sector a/	No. of establishments	Average output per establishment Rs.	Employment (direct) in Rs. 1m production b/ No.of persons	Payment to labour (direct) in output b/ %	Gross capital assets per worker c/ m.v. Rs.	Machinery and tools per worker m.v. Rs.	Capital output ratio m.v. Rs.
Traditional	100	below 50,000	410 d/	36	400-2,000	1-700	0.3-0.8
Small-scale including traditional	169	below 300,000	130 d/	21	400-12,000	1-7700	0.3-1.9
Modern medium-scale	28	300,000 1,000,000	40	10	6,400-44,000	2,500-24,000	0.4-1.6
Modern industrial	12	above 1,000,000	37	17	9,800-2,17,000	3,300-1,82,000	0.2-4.3

m.v. - market value of assets.

a/ Principal materials in the different sectors are given below. Some materials are manufactured in more than one sector. Traditional: Bricks, country tiles, sand, lime, cadjan, etc. Small-scale: Timber, cement products, brassware, aggregate, drainage fittings, electrical fittings etc. Modern medium-scale: Flat tiles, paint, varnish and distemper, wire nails, electrical fittings and switches, brassware and other fitting, etc. Modern industrial: Cement, steel, plywood products asbestos cement products, hardware, ceramics, plastic pipes, electrical cables, etc.

b/ At ex-factory price.

c/ Working capital was not included.

d/ A part of this employment is part-time or seasonal. No allowance has been made for this in the computations in this table.

Source: Ganesan (1979), op. cit., p.25.

* Table 2 reproduced from Ganesan (1982).

Table 3: Labour, capital resources used and capacity utilization in selected materials production units, Sri Lanka (1973 values)

Building material	No. of establish-ments	Direct employ. in Rs. Im production no. of persons	Income generation (direct)(percen-tage)	Capital assets per worker (m.v.) Rs.	Machinery and tools per worker (m.v.) Rs.	Capacity utilization (percentage)
Traditional and small-scale units						
Bricks	37	1,120	47	700	10	67
Sand	13	850	79	400	13	44
Country tiles	4	850	47	500	6	63
Cadjan	5	800	52	400	1	44
Aggregate						
(a) Manual quarry	2	560	45	1,300	110	81
(b) Mech. crusher	6	110	21	8,400	4,000	14
Lime	17	240	28	1,600	40	50
Brassware	19	140	25	1,400	700	53
Drainage fittings	15	100	26	7,300	3,700	65
Modern medium-scale and large industrial units						
Flat tiles	5	140	21	6,400	2,500	65
Hardware	1	100	31	25,000	20,000	25
Cement	1	26	14	93,000	46,000	67
Asbestos cement	2	16	10	12,000	5,100	68
Steel	1	16	9	59,000	29,000	41
Paint, varnish, distemper, etc.	9	14	8	26,000	14,000	31

m.v. = market value
Source: Ganesan (1979), op. cit.

Table 4. Production characteristics of different roofing materials in Sri Lanka, 1973

Sector	Building material	No. of establishments	Total employ. in Rs. 1m production No. of persons	Capital assets per worker (m.v.) Rs.	Machinery and tools per worker (m.v.) Rs.	Capital output ratio (m.v.)	Foreign exchange content in output (percentage)	Capacity utilization (percentage)
Traditional	country tiles	4	960	500	6	0.5	0	63
Modern-medium-scale	flat tiles	5	220	6,400	2,500	0.9	10	65
Modern-industrial	flat tiles	1 (6 factories)	220	11,000	5,700	1.5	10	75
Modern-industrial	asbestos-cement products	2	23	12,000	5,100	0.2	41	68
Modern-industrial	G.I. sheets	1	7	82,000	n.a.	0.6	82	n.a.

m.v. = market value.
Source: Ganesan (1979), op. cit., p.30.

Table 5. Foreign exchange requirements in production of building materials, Sri Lanka, 1973

Building materials	Foreign exchange cost as percentage value of output at ex-factory price				Total foreign exchange cost Rs. m c/
	Raw materials	Energy a/	Maintenance (+depreciation) b/	Total	
Cement d/	6	13	6	24	20
Cement products	0	8	0	8	
Steel products	53	2	2	57 e/	32
Timber	0	2	1	3	3
Bricks	0	0	0	0	0
Tiles	0	8	2	10	2
Aggregate	6 f/	4	2	12	3
Sand	0	0	0	0	0
Earth, clay, etc.	0	0	0	0	0
Lime	0	0	0	0	0
Asbestos cement products	39	0	1	41	13
Special steel fixtures	-	-	-	100 g/	15
Paint, varnish, etc.	60	0	1	61	4
Hardware	32	4	2	38	12
Sanitary-ware	13	4	2	19	2
Sanitary pipes	37	2	4	43	4
Electrical fittings	47	1	4	51	12
Cadjan	0	0	0	0	0

a/ Mostly furnace oil and resources for generation of electricity locally.
b/ Assumed to be 3 per cent of replacement value of machinery and tools which is considered essential for purchase of spare parts and to meet at least part of depreciation cost of imported machinery.
c/ Adding foreign exchange required in other materials, transport, and plant and equipment, total requirement in 1973 for all construction was approximately Rs.200 M.; together with other requirements, final requirement of foreign exchange was about 10 per cent of gross foreign exchange earnings of Sri Lanka in 1973. This figure (10 per cent) does not include foreign resources required for new investment in the building materials sector. The percentage is probably much higher now.
d/ Crude estimate after oil price increases in 1973 and 1974. The largest component is from import of furnace oil: Import of gypsum and paper for cement bags also included under 'raw materials'.
e/ This figure is almost much higher today.
f/ Mostly blasting powder.
g/ Wholly imported.
Note: Discrepancies due to rounding.
Source: Ganesan (1979).

Table 6. Unit production costs of brickmaking

Process	Unit Production Costs (US cents per brick) (medium wage economy)	(low wage economy)
Capital-intensive all year round	6.5	6.2
'Least-cost' all year	3.1	2.3
'Least-cost' seasonal working only	2.9	2.0

Source: Keddie, J., Cleghorn, W. "Least Cost Brickmaking" in Appropriate Technology, vol.5, no.3, 1978.

It was found that buildings constructed in bricks and blocks varied in cost (according to techniques chosen) from $30 to $50 per square metre and in timber from $30 to $35 per square metre. On the other hand, the cost of construction in timber and bamboo was $15 per square metre, in mud $8 per square metre and in bamboo alone only $5 per square metre. Although the reliability of such figures can be questioned, they do give a rough indication of the order of magnitude of the differentials involved, showing that the least expensive basic construction material available costs 10 times less than the conventional bricks and blocks.

Of course, the quality of materials must also be taken into account. Thus, it is commonly known that a structure built with materials such as mud and bamboo may last for only a few years without repairs. However, it is sometimes possible to improve these basically 'impermanent' materials - thereby extending their life by a number of years. For example, the life of bamboo used in construction may be lengthened from 5 to 15 years by a process of impregnation. If 30 per cent is added for the cost of this treatment, the construction cost per square metre at $6.50 per square metre is still unrivalled. A study of traditional and modern materials used in house construction in Bangladesh revealed a cost differential of 13:1 in favour of the former, and, in this instance, it was estimated that, even if account is taken of the need to make constant repairs to traditional housing, traditional materials are still half the price of modern ones.

It should also be noted that the production of traditional building materials is particularly suited to small units. This is because the product is heavy, bulky and of low value, so that production in small units, located close to markets, offers significant savings on transport costs. Thus, the price differential on delivered costs of materials produced in small and large-scale units may be even greater than the foregoing comparisons imply.

As the total capital cost of the latter is also very much greater, the differential in terms of foreign exchange requirements between the two production processes is somewhere in the order of 200:1. In addition, the small-scale informal units operate their kilns using locally available sources of fuel, so that there is no imported element in the running costs - a fact that is confirmed by the data presented for brickmaking in table 5.

Table 5 also shows the foreign exchange requirements for the production of sand, earth, clay and lime to be nil. While there is an imported component in the production of tiles and aggregates, it is relatively small (10 and 12 per cent of output price respectively). This can be contrasted with the high foreign exchange costs involved in the production of steel and steel products (57 to 100 per cent of the output value respectively); paint (61 per cent); electrical fittings (51 per cent); sanitary pipes (43 per cent); hardware (38 per cent); and cement (24 per cent).

In terms of roofing materials (table 4), while there is no foreign exchange element in the costs of locally produced country tiles, for asbestos-cement the foreign cost element is 41 per cent of the value and, for g.i. sheets, it is an incredible 82 per cent - of particular significance in view of the apparent popularity of the latter in almost all developing countries.

Production costs

In addition to requiring less capital and foreign exchange, building materials produced in small-scale informal units require less machinery and equipment than their large-scale counterparts. The only significant input is unskilled labour. Thus, costs of production are also relatively low. A comparison of the costs of producing bricks, using alternative processes, is shown in table 6. It can be seen that unit costs range from 2 U.S. cents per brick in small-scale traditional industries to 6.2 cents in modern industrial plants (the differential is slightly less in highwage economies). Thus, capital-intensive methods for the production of bricks are three times more expensive than the least-cost alternative. An interesting comparison of costs/per square foot of finished construction product using different types of materials, was made by the ECE in 1967.

NOTES

1. For example, Kenya, the United Republic of Tanzania and the Ivory Coast. See Edmonds and Miles (1984).

2. Mtui, 1980

3. Ganesan (1982), notes that all raw material requirements for the local production of steel and hardware are imported as well as 80 per cent for the plywood industry and 20 per cent for timber industry.

4. Wells, 1984.

5. Frequently, costs of production are higher than those for similar imported items; local products are therefore heavily protected by tariffs and/or direct import restrictions.

6. Tackie (1981).

7. Tenga, Sauni and Marealle (1982).

8. World Bank (1978).

9. Abbas (1980).

10. Lubell, H. and McCallum, D (1978).

11. Based on Wells (1969).

12. Ganesan (1982).

13. Abbas, op.cit.

14. Ganesan, op.cit.

15. Radha Sinha in Sethuraman (ed.) (1984).

16. King (1977).

17. Parry, J.P.M. (1983).

18. See Appendix, see also Ganesan (1982).

19. The term was adopted by Gerry (1974) in his analysis of the variety of forms of production operating around the dominant capitalist mode in Dakar, Senegal.

20. Sethuraman, in his work for the ILO, distinguishes between informal sector enterprises existing primarily for employment creation, as opposed to small-scale enterprises primarily concerned with profit maximization (1981).

21. Steel was the first to introduce the term 'intermediate sector' in his work on Ghana (1977); he defines the sector as comprising enterprises with some investment in fixed capital assets, and a fixed place of business, but with less than 30 employees; in Ghana, more than 40 per cent of the manufacturing industry would fall into this sector, and the sector is also responsible for the generation of a greater volume of employment than is to be found in commerce and manufacturing in the modern sector.

22. See Moser (1983).

23. The question as to whether the relationship between the 'informal' and the 'formal' sectors of the economy is exploitative or benign has been the subject of considerable debate for a number of years. For an excellent summary and evaluation of the arguments, see Moser (1983).

24. Sutcliffe (1971).

25. Wells (1984), see also Ganesan (1983), who estimates a "leakage" of 55-80 per cent in Sri Lanka.

26. ILO Technical Memorandum on brickmaking (see Appendix).

27. Ganesan (1982).

28. House (1978).

29. Sethuraman (1981).

30. Child (on rural Kenya)(1983).

31. See Abbas, op.cit.
Ganesan (1983), op.cit.

32. ILO Technical Memorandum on brickmaking.

33. See for example, ECE, 1967.

34. ILO, op.cit.

35. Osorba (1981).

36. For example, the work of the Building Research Unit in the United Republic of Tanzania, supported by Norwegian aid.

37. See King (1977) and Schmitz (1982).

38. See the work of Sethuraman, Steel, Schmitz, House and Gerry, op.cit.

39. Gerry (1974).

40. See Steel (1977) for small manufacturing enterprises; Sethuraman (1984) for attempts to promote small industries in the rural areas; and various ILO studies on the promotion of small contracting firms.

41. See, for example, the work of Sethuraman, House, Schmitz and Muench, op.cit., among others.

42. Ofori (1980).

43. Parry, J.P.M. (1981).

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